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Interactive comment on "Features of the Earth surface deformations in Kamchatka peninsula and their relation with geoacoustic emission" *by* I. A. Larionov et al.

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Dear Sir, Thank you for your comments. We'll reply on your remarks in step by step format.

1. Of course, there is a laser strainmeter response on environment changes, especially in the instrumentation installed on the ground and without different protective means. That is why at the point of deformation registration a digital meteostation is installed. We've taken into account the weather parameter effect. Wind, precipitation, air temperature and pressure affect the strainmeter data the most. To protect it from wind and precipitation effect, we used a special covering. We should note that the change of

meteorological parameters (especially air pressure and temperature) is a slow process which occurs within several hours. Fig. 5a and 6a illustrate the data from which it is clear that the strainmeter registered deformation changes with the period from seconds to several minutes. Moreover, we estimated deformation rate (Fig. 5b and 6b). Thus, air temperature and pressure changes may not be considered during the analysis of such short effects.

2. As we have already mentioned before, we do take into account meteorological parameters. Of course, we plan to install laser strainmeters at other sites in the future, but a laser strainmeter is a very expensive instrumentation. It should be also mentioned that in the present experiments we study the local peculiarities of near surface rock deformations and the response in geoacoutic emission on them. Karymshina station is located in a unique place even for Kamchatka, in the zone of different rank tectonic faults. So, it is quite possible that in another place in Kamchatka, the relative deformation of the near surface rocks will have absolutely different dynamics. Undoubtedly, the extension of observation sites for the measurement of relative deformations is the direction of our work in the future. To our point of view this remark is not the reason for negative review and does not lessen the significance of the performed investigations and our conclusions, but should be considered as a suggestion for the future development.

3. We made the correlation analysis of separate, the most interesting fragments with anomalies in relative deformations and geoacoustic emission. The examples of such analysis are considered in the paper (Fig. 7, Fig. 8). As for statistic analysis of the relation between the acoustic emission and deformations on long data series, such investigations have not been carried out. They are the direction of our future investigation and we plan to devote a separate scientific paper to it. We think that such analysis on long data series is undoubtedly important but it is out of the scope of this paper. The main aim of our paper is to show the fact registered in the natural experiment, that periods of primary tension and primary compression with the duration of several month

are distinguished in the geodeformation process at the registration site, as well as that during the changes of deformation direction, when the geodeformation process rate increases, the level of geoacoustic radiation grows.

The specific points in question:

– The light guide was used at the stage of adjustment and testing of the strainmeter operation. In the result of the first year of measurements we made the conclusion that we may refuse it and change it to a simple covering from precipitation and wind. It is due to the fact that during the most time of the year (from November till June) there is much snow (the height is more than 2 meters) at the site, which is like a thermos stabilizing the temperature and protecting from wind and precipitation. When there is no snow cover, the readings of the strainmeter are controlled thoroughly and separated according to the readings of the meteostation located at the place of observations. To exclude the effect of air pressure, we estimate the deformation rate which shows fast changes of deformation process and correlates with acoustic disturbances.

– We used a frequency-stabilized laser for our measurements. The technical specifications show the frequency stability for more than 1 min is +-2x10ˆ{-9}; for more than 24 hours, it is +-2x10ˆ{-8}, which allows us to carry out our deformation measurements confidently.

– We consciously removed some data including the meteoparameters which did not affect the recorded data in order not to overload our paper. As it was already mentioned above, when there is a snow cover, only air pressure affects the registered data of the strainmeter, but is a slower process. In summer time temperature and wind effects are possible. But during the whole year we thoroughly analysis the data for such effects.

– Processing of acoustic pressure data is carried out as follows. An acoustic signal with the sampling rate of 44100 Hz is processed by digital filters with the frequency range indicated in the paper. Than detection (abs procedure) and gathering on a second interval are performed. That is why the values are only positive. The change of

deformation strain in the given case is really the change in the negative side which corresponds to the compression of the strainmeter bases. The case shown in Fig. 5 and 6 is a unique one as long as the occurrence of such strong disturbances in the observations coincided with the fortunate time of noise-protection of the observations. During other periods in the most cases, multidirectional changes are observed. Than, we had to be guided by the comparison of acoustic pressure and deformation rate because it is difficult to detect fast and small rock shifts on long-period deformation graphs.

– The strain change of 3.5x10ˆ{-3} is really very large. The authors think that the reasons are the flolloing. Surface sedimentary rocks on the bank mountain slope of Karymshina river are constantly in motion, it is a shear plastic flow the velocity of which exceeds the velocities of regional plastic deformations in Kamchatka by several orders. The rocks on the steep slopes are always close to almost critical, avalanche-prone state, so they are so sensetive to weak deformation disturbances which occur locally, in close proximity, and as a resutl of remote earthquake precursors. We should also consider that the strainmeter is installed in the zone of different rank tectonic faults. Their dynamics may cause significant changes in surface sedimentary rocks. In the paper we removed the trand determined by instrumentatio peculiarities of the registration system. When some failure occurred in the operation of the strainmeter or the meteoparameters had a great impact, we also removed the data from the discussion. Thus, we think that the strain chage 3.5x10ˆ{-3} shows the real bases change and is not determined by errors.

– Energy class K is one of earthquake characteristics. It denotes the following. Earthquake energy (measured in Joles) is E=10K, where K is the given energy class. That is why the authors consider it to be correct enough to use K for estimation of the accumulated energy in the region of earthquake preparation. Of course, the seismologists use magnitude M to estimate earthquake energy more frequently. There exist many different estimations of magnitudes. It can be estimated from body waves, from surface waves. The most known is the Richter scale. Seismologists in Kamchatka use the

Fedotov scale M=(K-4.6)/1.5. For more convenience, magnitude values will be given together with the energy class in the final version of the paper.

Best regards, I. Larionov and Yu. Marapulets.

Interactive comment on Solid Earth Discuss., 6, 2401, 2014.